

(12) UK Patent Application (19) GB (11) 2 333 558 (13) A

(43) Date of A Publication 28.07.1999

(21) Application No 9900678.5

(22) Date of Filing 14.01.1999

(30) Priority Data

(31) 09013436 (32) 26.01.1998 (33) US

(71) Applicant(s)

Motorola Inc  
(Incorporated in USA - Delaware)  
Corporate Offices, 1303 East Algonquin Road,  
Schaumburg, Illinois 60196, United States of America

(72) Inventor(s)

Philip S Higdon  
James Barber  
Derek E Jensen

(74) Agent and/or Address for Service

Motorola Limited  
European Intellectual Property Operation, Midpoint,  
Alencon Link, BASINGSTOKE, Hampshire, RG21 7PL,  
United Kingdom

(51) INT CL<sup>6</sup>

H04M 1/02, E05F 1/12

(52) UK CL (Edition Q )

E2F FAA FAE

(56) Documents Cited

GB 2300881 A EP 0765063 A WO 93/18592 A  
US 5764760 A

(58) Field of Search

UK CL (Edition Q ) E2F FAA FAE  
INT CL<sup>6</sup> E05D 11/10, E05F 1/12, H04M 1/02  
Online: WPI

(54) Abstract Title

Hinge for a wireless communication device

(57) A wireless communication device or radiotelephone has a body (102) and a cover (104), the body having a recess (103) with shoulders for attaching the cover, the device comprising a barrel (124) integral with the cover with a closed and open end, a pin (127), a spring (116) located in the barrel, a cam (118) located in the barrel in contact with the spring and being formed with a curved profile at its opposite end and with a key, and a follower (120) with a head in contact with the curved surface of the cam and a connector at its opposite end. The pin (127) is rotatably disposed in a cavity in one shoulder, and the connector of the follower in a cavity (107) in the other shoulder to restrict movement of the follower. In the hinge's open position, the head is in contact with a valley of the cam surface, and when in its closed position is in contact with a peak. The key of the cam fits into a slot in the barrel.

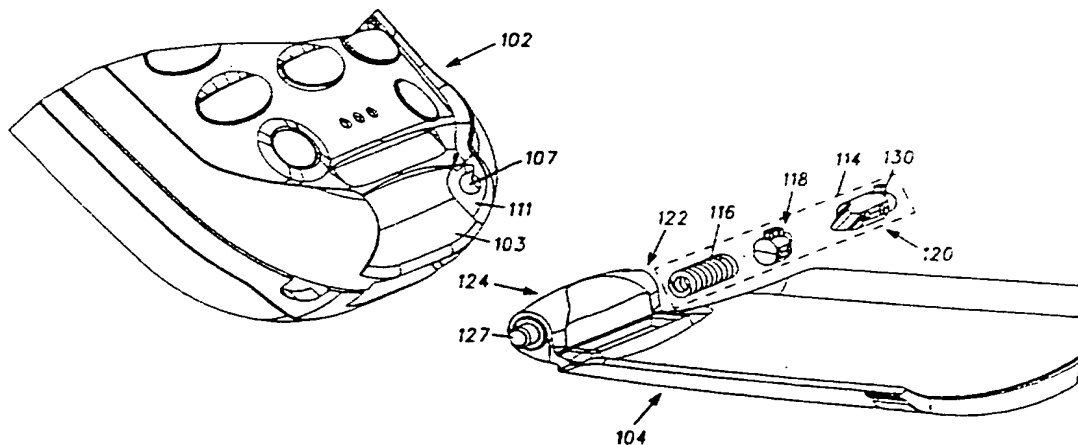
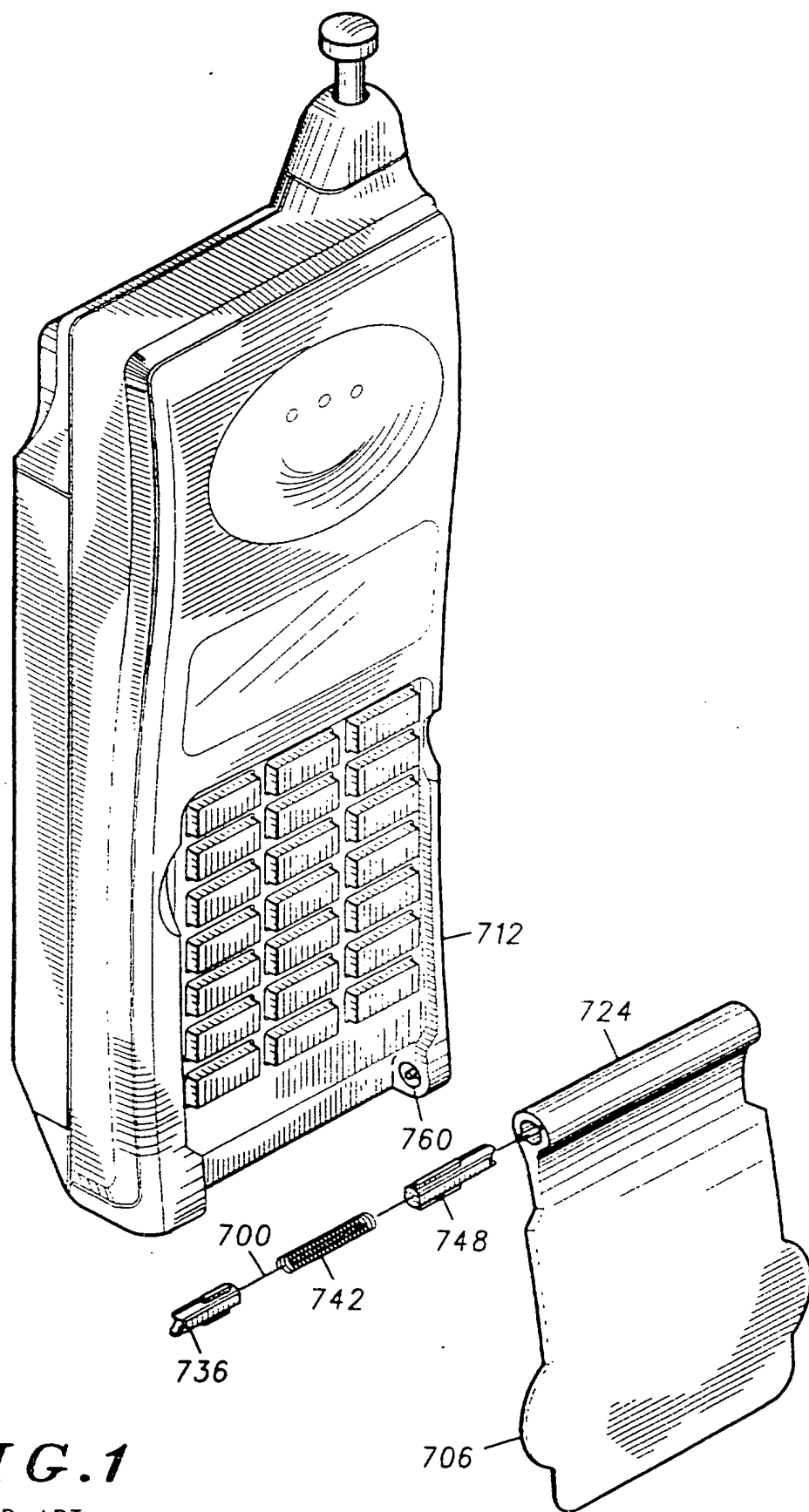


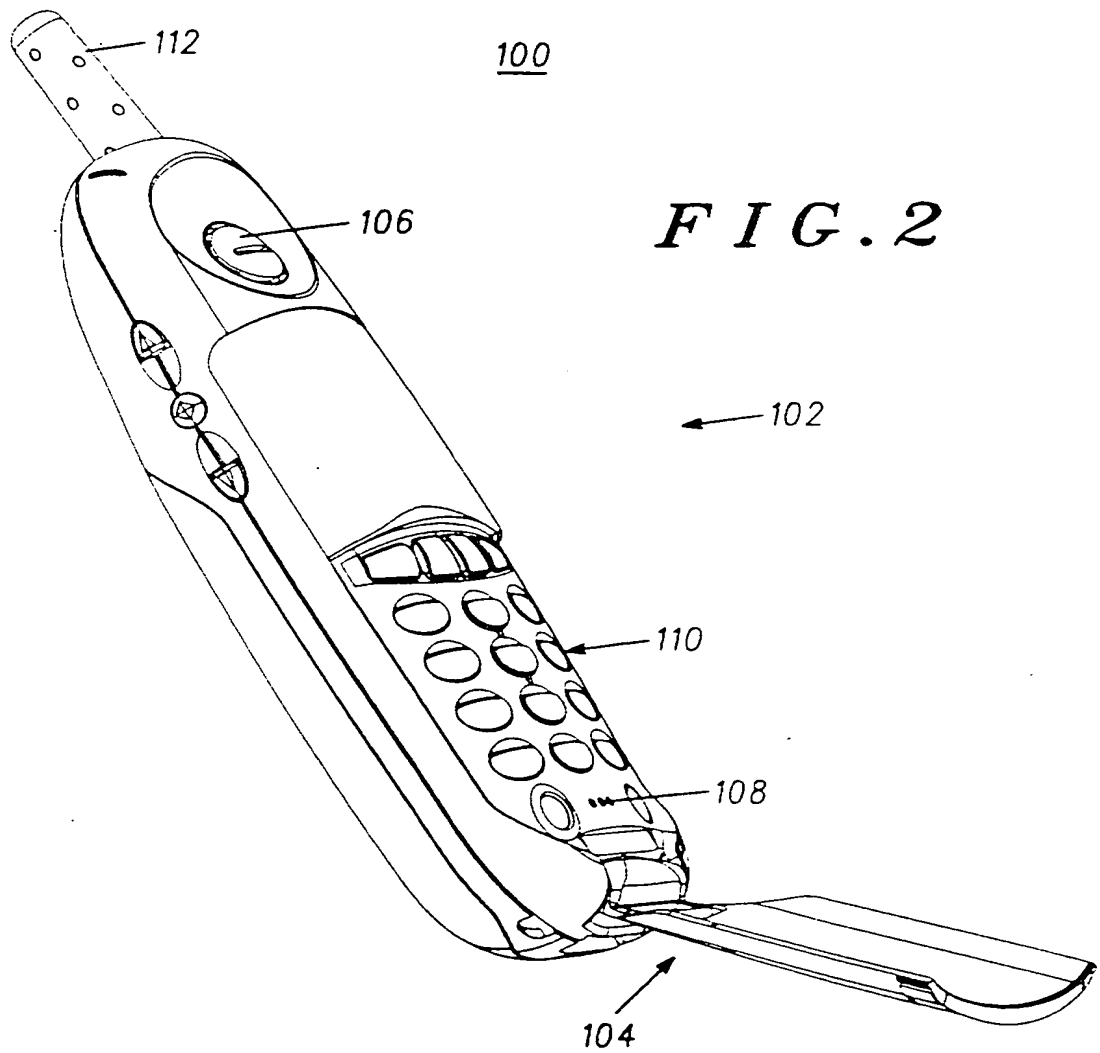
FIG. 3

GB 2 333 558 A

1/7



**FIG. 1**  
—PRIOR ART—



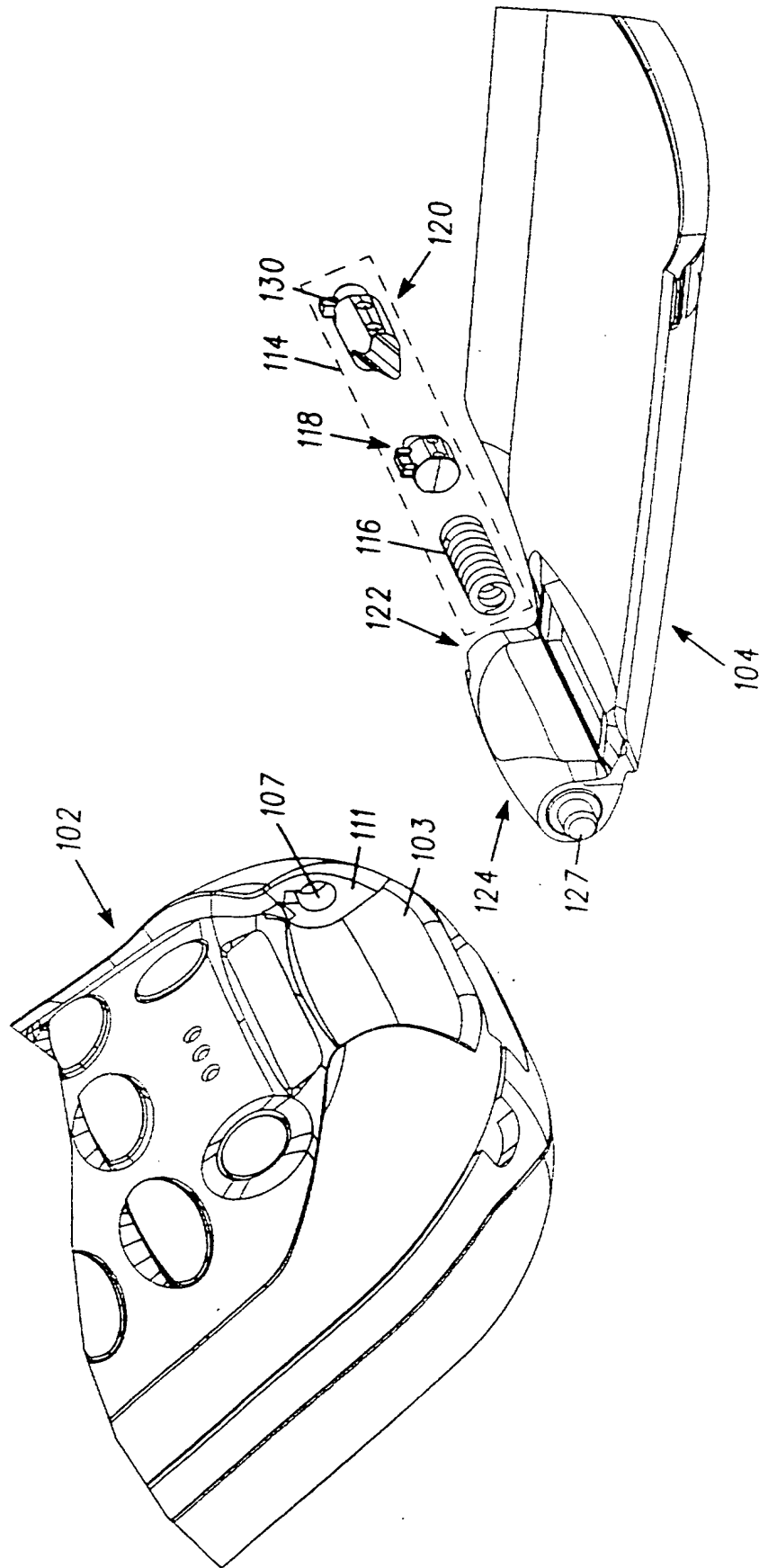


FIG. 3

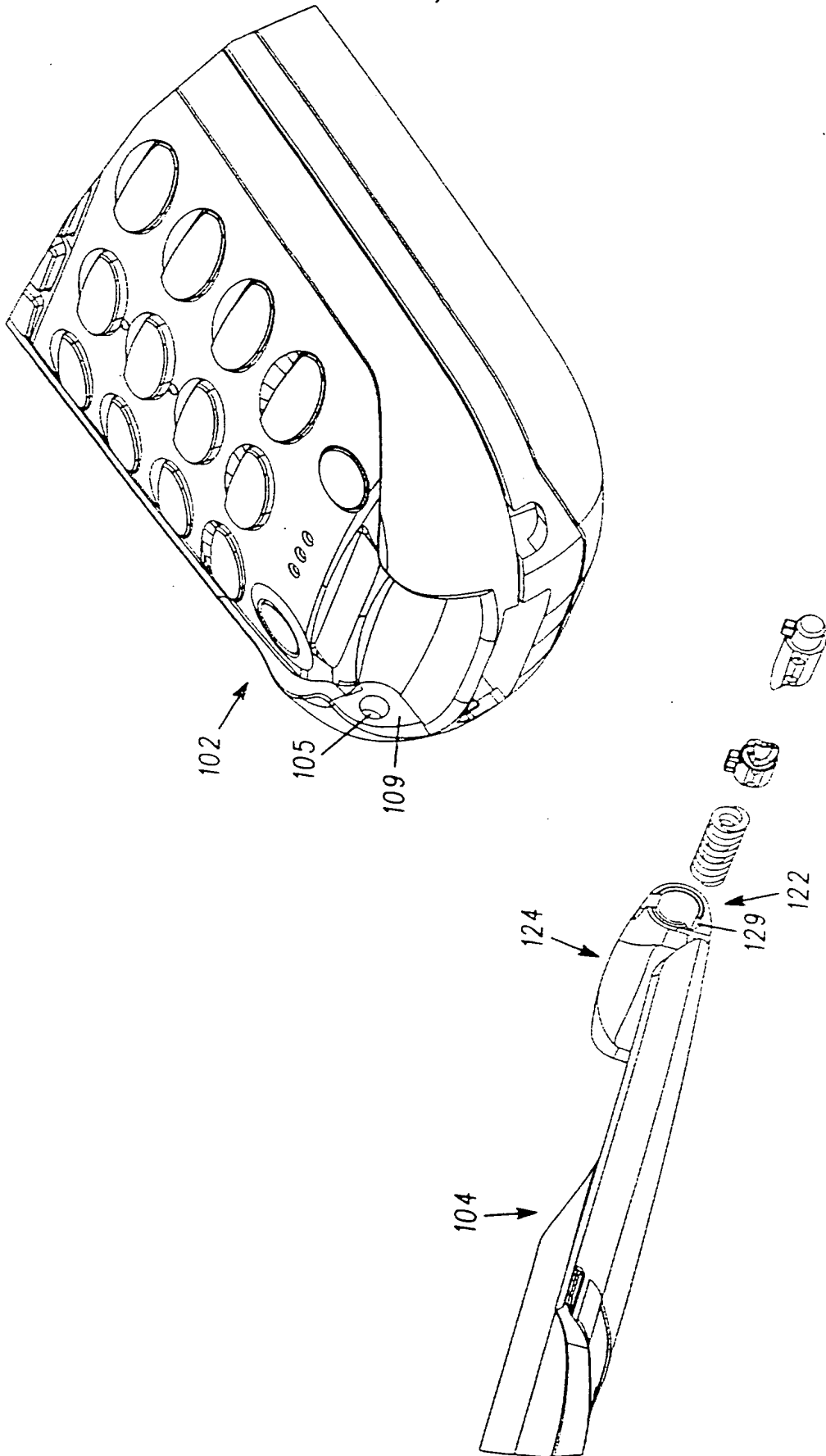


FIG. 4

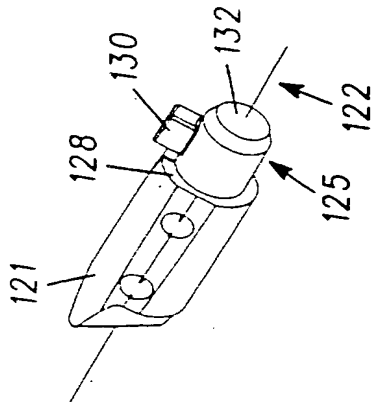


FIG. 6

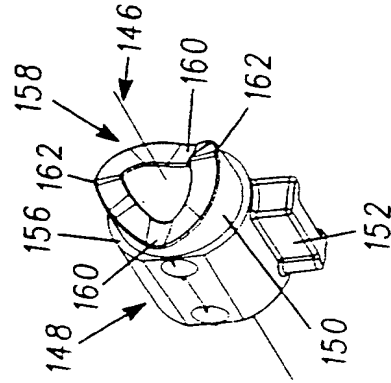


FIG. 8

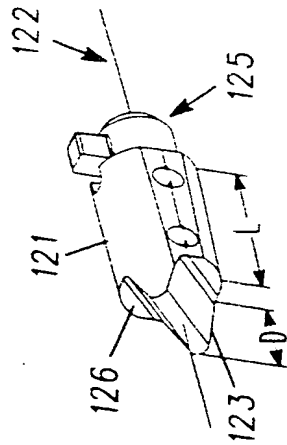


FIG. 5

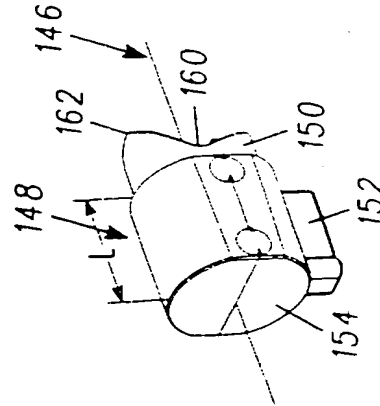


FIG. 7

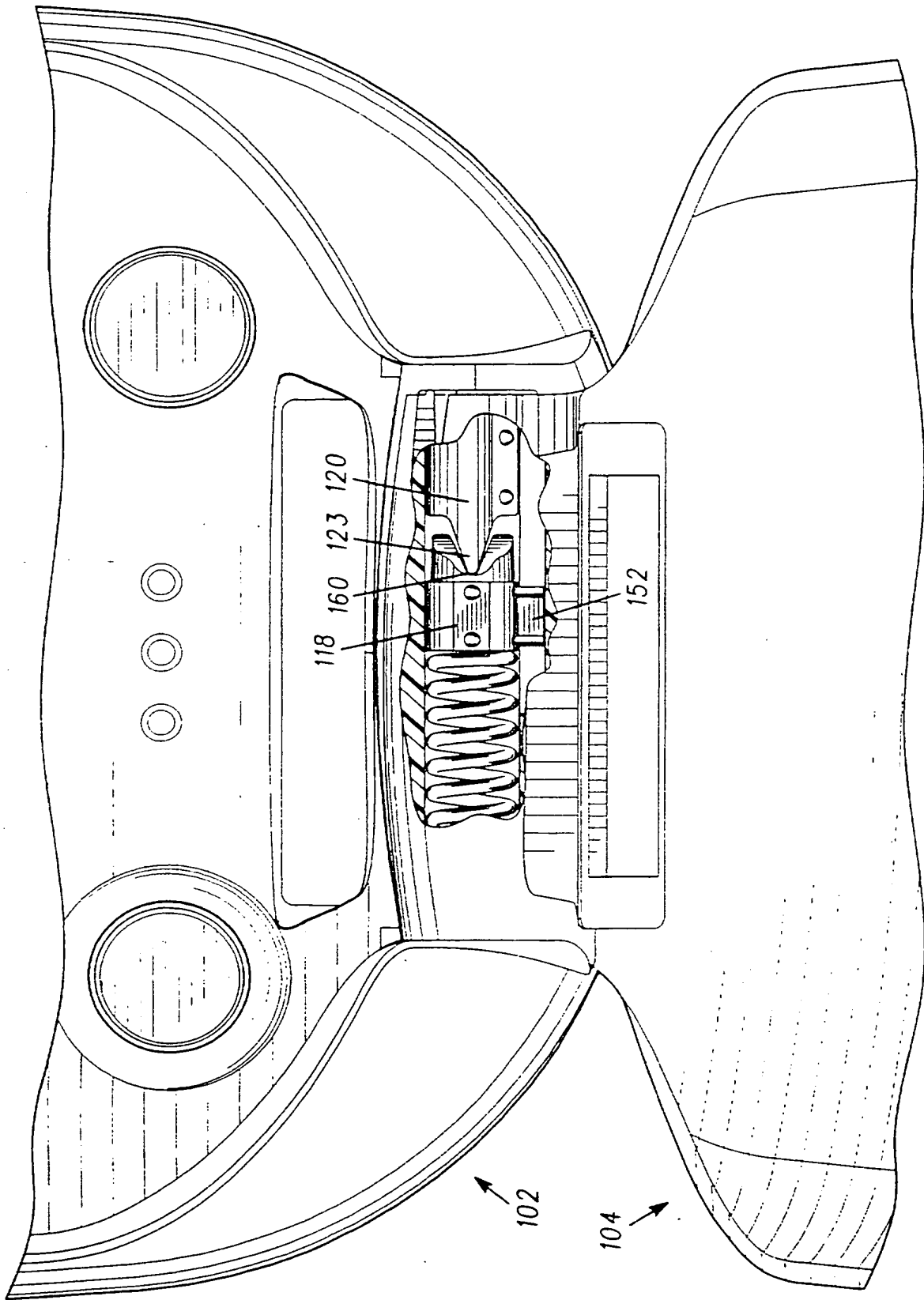


FIG. 9

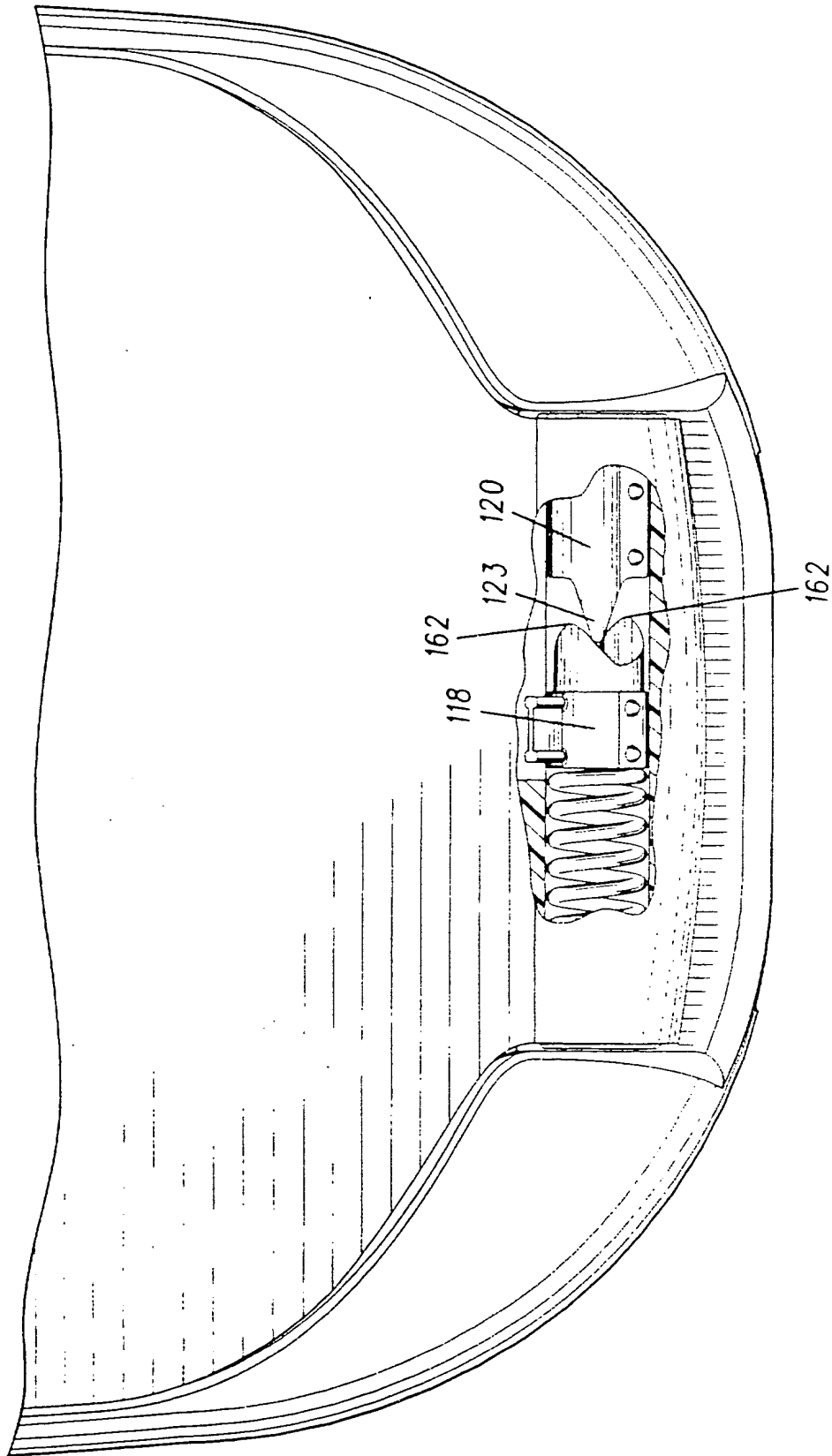


FIG. 10



## HINGE MECHANISM

### Field of the Invention

5 The present invention relates generally to apparatus for hinging the housing of a foldable, portable wireless communication device. Although the invention is subject to a varied range of applications, it is especially suited for use in a handheld radiotelephone, and will be particularly described in that connection.

### Background of the Invention

10 Portable radiotelephones are increasingly utilized to permit a user to communicate telephonically over a wireless system at virtually any location. The portable telephone transmits a low wattage, radio frequency signal to a receiving station, which may be connected with conventional landline  
15 telephone systems.

Portable radiotelephones having two housings joined by a type of hinge that allows the housings to fold upon one another are known in the art. Some such folding radiotelephones have most of the electronics in one housing called the main housing and fewer electronics in the other housing,  
20 called the cover. Other such folding radiotelephones have all the electronics in the body with the cover serving only to cover the keypad or keypad and display of the phone.

Some known portable cellular radiotelephones utilize, as shown in FIG. 1, a hinge mechanism having a spring 742 and hinge pins 736, 748  
25 disposed in a tubular hinge arm 724 formed at an end of a cover 706, and bushings 760 formed in body 712. Spring 742 is positioned between hinge pins 736, 748, and at all times outwardly forces hinge pins 736, 748 from cover 706 to body 712. Examples of such known radiotelephones are described in PCT Publication No. WP 93/18592, published Sep. 16, 1993  
30 and U. S. Pat. No. 5,274,882, issued Jan. 4, 1994. Radiotelephones employing the hinge mechanism described above are typically "squared" at the bottom of the main housing to accommodate the bushing 760. Although the "squared" look may be desirable to some, others may desire a less bulky, more contoured design.

Another portable telephone utilizes hinge 301 shown and described in U. S. Patent No. 5,628,089 by Wilcox et al., entitled "Radiotelephone Having a Self Contained Hinge," issued May 13, 1997, and assigned to Motorola, Inc. The hinge 301 comprises a spring 405, a cam 404 and a follower 403 assembled into a cylindrically hollow can 303 via an open end thereof and held in assemblage by a cap 305 coupled to the can 303 over the open end. The assembled hinge 301 in can 303 is disposed in a cavity 307 of cover 103 and a cavity 503 of body 101. The self contained hinge may be desirable to some radiotelephone manufacturers because it can be purchased as a separate unit, thereby eliminating the steps associated with assembling the hinge during manufacturing. However, to other radiotelephone manufacturers that produce their own hinges, the self contained hinge adds complexity to the manufacturing process and increases the number of parts used.

Thus, a need exists for a hinge for use in a foldable device, such as a portable radiotelephone, that allows for a rounded, contoured design for the foldable device while minimizing the number of parts and simplifying the manufacturing process.

#### Brief Description of the Drawings

FIG. 1 is an exploded perspective view of a known radiotelephone.

FIG. 2 is a perspective view of a radiotelephone including a preferred embodiment of the hinge of the present invention, the radiotelephone in an open position.

FIG. 3 is an exploded, fragmentary, left perspective view of the radiotelephone of FIG. 2 further illustrating the hinge components.

FIG. 4 is an exploded, fragmentary right perspective view of the radiotelephone of FIG. 2 further illustrating the hinge components.

FIG. 5 is a left perspective view of the preferred embodiment of a follower of the hinge shown in FIG. 3.

FIG. 6 is a right perspective view of the preferred embodiment of a follower of the hinge shown in FIG. 4.

FIG. 7 is a left perspective view of the preferred embodiment of a cam of the hinge shown in FIG. 3.

FIG. 8 is a right perspective view of the preferred embodiment of a cam of the hinge shown in FIG. 4.

FIG. 9 is a cross sectional view of the radiotelephone of FIG. 1 in the open position illustrating the coupling of the hinge components .

5 FIG. 10 is a cross sectional view of the radiotelephone of FIG. 1 in the closed position illustrating the coupling of the hinge components .

### Summary of the Preferred Embodiment

10 The present invention provides a hinge mechanism for a wireless communication device. In the preferred embodiment, the hinge mechanism includes a body and a cover of a wireless communication device, the body having a recess bordered by a left shoulder and a right shoulder for attaching the cover thereto. The hinge further includes a barrel integrally formed on the cover, the barrel having a closed end and an open end;  
15 a pin molded to an exterior surface of the closed end of the barrel; a spring disposed in the barrel; a cam disposed in the barrel having a body with a front surface in contact with the spring and a rear surface with a curved profile, the cam body having a key formed thereon; a follower partially disposed in the barrel having a head on one end in contact with the profile of the cam and a connector on an opposite end that extends through the open  
20 end of the barrel, wherein the connector comprises a first portion and a second portion formed on an exterior surface of the first portion. The pin formed on the barrel is rotatably disposed in a cavity in the left shoulder and the connector is disposed in a cavity in the right shoulder in a manner that  
25 restricts movement of the follower when the cover is moved between an open position and a closed position.

The hinge configuration of the present invention eliminates pins pressed into the bottom portion of the body of the radiotelephone, thereby allowing the bottom portion to have a rounded, contoured design. A cost  
30 savings is realized from the elimination of these pins and the labor associated with pressing the pins into the body of the radiotelephone. Further, the present hinge can be disposed directly in a portion of the cover of the radiotelephone, thereby eliminating the cost and labor associated with a separate housing for the hinge elements.

Additional advantages and novel features of the invention will be set forth in part in the description which follows, wherein the preferred embodiment of the invention is shown and described. Reference will now be made in detail to an embodiment configured according to the present invention.

### Description of the Preferred Embodiment

A radiotelephone includes two housings, a cover and a body, rotatably coupled by a hinge about an axis of rotation. The hinge has a stationary element, such as a follower, and two moveable elements, such as a cam and a spring, held in engagement with the stationary element in a barrel formed at an end of the cover. The cover with hinge elements contained therein is coupled to the body on one end of the barrel by a cylindrical pin molded thereon and on the other end by a pin integrally formed on the follower which extends through the opposite end of the barrel. This configuration minimizes the number of hinge components and allows the bottom portion of the device to achieve a rounded contoured design.

The wireless communication device that incorporates the preferred embodiment of the hinge of the present invention is illustrated as a radiotelephone 100 in FIG 2. The radiotelephone 100 has two portions, a body 102 and a cover 104. FIG. 1 shows cover 104 in an open position such that a user of the radiotelephone 100 can listen via earpiece 106 and speak into microphone 108. The body 102 includes a keypad 110 having a plurality of buttons numbered one through zero, #, and \*, in a conventional telephone arrangement. The keypad 110 may also have additional buttons such as power, function, send, and other buttons associated with telephone number recall. The body 102 also has an antenna 112 that enables wireless communication between radiotelephone 100 and a base station (not shown) of the cellular radiotelephone system.

As embodied herein and referring to FIG. 3, an exploded left perspective view of the hinge 114 of the present invention is shown. Also, shown in FIG. 3 are fragmentary perspective views of cover 104 and body 102 of radiotelephone 100. As shown, hinge 114 includes a spring 116, a cam 118, and a follower 120. During assembly, hinge 114 is preferably

disposed in an open end 122 of a barrel 124 of cover 104. Cover 104 is then disposed in a recess 103 of body 102 and rotatably coupled to shoulders 109 (FIG. 4), 111 of body 102 in a manner that allows cover 104 to be moved between an open and closed position with respect to body 102.

5         Details of hinge 114 will now be described. The hinge 114 preferably has a stationary element, which in the preferred embodiment, is a follower 120; and two movable elements, which in the preferred embodiment, are a cam 118 and a spring 116. The follower 120 is shown in FIGs. 5 and 6 to be generally cylindrical with a longitudinal center axis 122. Preferably, 10  
10         follower 120 is injection molded using an acetal resin such as Delrin® 500 commercially available from DuPont, or other suitable material., Preferably, the follower 120 has three integral portions joined along the axis 122: a body 121, a head 123 and a connector 125.

15         The follower body 121 is formed of a cylindrical portion.. Preferably, one end of body 121 is defined by a flat front surface 126. The other end of body 121 is preferably defined by a flat rear surface 128 (FIG. 6).

20         The connector 125 is formed of a cylindrical portion with a locating rib 130 integrally formed thereon. Preferably, the diameter of the cylindrical portion is slightly less than the diameter of the follower body 121. Both a front end 132 and a rear end (not shown) of connector 125 are defined by flat surfaces. The rear end 132 is coupled to the flat rear surface 128 of body 121.

25         The head 123 of follower 120 is joined to body 121 at a flat surface thereof (not shown). Preferably, head 123 is conical in shape and has a depth D of approximately 2.00 mm. The function of head 123 is to follow the profile of the cam 118 (described in detail below) when the cover 104 is cycled between the open and closed positions.

30         Cam 118 is shown in FIGs. 7 and 8 to be generally cylindrical with a longitudinal, center axis 146. Cam 118 is preferably injection molded using Delrin® 500 acetal resin commercially available from DuPont, or other suitable material. Preferably, the cam 118 has two distinct integral portions joined along axis 146: a cam body 148 and a cam head 150.

35         Cam body 148 is formed of a cylindrical portion. In the preferred embodiment, cam body 148 has a length L of approximately 3.00 mm and a diameter of approximately 3.25 mm. Preferably, one end of cam body 148 is

defined by a flat circular front surface 154. The other end of cam body 148 is preferably defined by a flat circular rear surface 156. The surface of cam body 148 has a key 152, preferably rectangular, formed thereon.

Cam head 150 is generally cylindrical. Preferably, one end (not shown) of cam head 150 is defined by a flat circular surface and is connected to flat circular rear surface 156 of cam body 148. The other end of cam head 150 is defined by a curved profile 158. The profile 158 has a valley 160 and two peaks 162.

Spring 116 (FIG. 3) is spiral shaped with an outer diameter slightly less than the inner diameter of barrel 124 of cover 104. Preferably, spring 116 is a compression spring composed of music wire or other suitable material, having an outer diameter of approximately 3.00 mm, a length of approximately 12.4 mm in its free state, approximately 12 coils, and a spring rate of approximately 63 lbs/in.. The ends of the spring 116 are closed and ground (i.e., flattened) to facilitate mating once the hinge 114 is assembled.

Referring now to FIG. 3, the barrel 124 of cover 104 has a molded pin 127 integrally formed on one end and an opposite end 122 open to accept the hinge components. The open end 122 defines a substantially circular opening with a key slot 129 (FIG. 4) extending into the barrel 124 to receive and mate with the key 152 affixed to cam body 148 (FIG. 8). The barrel 124 preferably has an inner diameter of approximately 3.12 mm. The molded pin 127 preferably has a diameter of approximately 2.50 mm and a length of approximately 2.00 mm. Preferably, cover 104 (including barrel 124 and molded pin 127) is injection molded using a polycarbonate blend, such as Cyloloy®, commercially available from General Electric.

Assembly of the hinge will now be described. First, the spring 116 is inserted into the barrel 124 of cover 104. Next, the cam 118 is inserted into the barrel 124 such that the flat front surface 154 of the cam 118 is coupled to the spring 116. Then, follower 120 is inserted into the barrel 124 such that follower head 123 is coupled to the curved profile 158 of cam 118. Next, the cover 104 is disposed in the recess 103 of body 102 of radiotelephone 100. In the recess 103, a left shoulder 109 (FIG. 4) includes a first cavity 105 shaped to receive the molded pin 127 of barrel 124. The recess 103 also includes a right shoulder 111 (FIG. 3) having a second cavity 107 shaped to receive the connector 125 of follower 120. As shown, the cavity 107

includes a rectangular portion to receive the locating rib 130 of connector 125.

As the molded pin 127 of barrel 124 is received into the first cavity 105 of the left shoulder 109, the follower connector 125 will find its location into the second cavity 107 of the right shoulder 111. The locating rib 130 of the follower connector 125, in conjunction with mating rectangular portion of second cavity 107 serves to guide the follower into place. The follower 120 is locked permanently in position by the force transferred to it via the cam 118 by the spring 116. Once the cover 104 of radiotelephone 100 is coupled to the body 102, the spring 116 provides the force necessary to move the cover 104 between the open and closed positions with respect to the body 102.

Referring now to FIGs. 9 and 10, it can be seen that as the cover 104 moves between the open and closed positions, the spring 116 expands and contracts, respectively. This movement causes cam 118 to move horizontally along its axis 146. The cam 118 also rotates about axis 146 as it follows the movement of the cover 104 between the open and closed positions. The key 152 of the cam body 148 disposed in the key-slot 129 which extends into the barrel 142, allows the cam 148 to remain coupled to the cover 104 as it is opened and closed. As stated previously, the follower remains locked in position as the cover 104 is opened and closed.

As shown in FIG. 9, when the cover 104 is in the open position, the valley 160 of the cam profile 158 (FIG. 8) receives the head 123 of the follower 120 to keep the cover 104 in the open position. As the cover 104 is moved from the open position to the closed position, the cam 118 rotates about its axis 146 until the head 123 of the follower 120 is positioned just past the peaks 162 of the cam profile 158 as shown in FIG 10.

The hinge of the present invention provides advantages over known hinges. It eliminates having to press pins into the bottom portion of the body of the radiotelephone, thereby allowing the bottom portion to have a rounded, contoured design. In addition, a cost savings is realized from the elimination of pins and labor associated with assembling the pins to the body of the radiotelephone. Further, the present hinge can be disposed directly in a portion of the cover of the radiotelephone, thereby eliminating

the cost and labor associated with a separate housing for the hinge elements.

Those skilled in the art will recognize that various modifications and variations can be made in the apparatus of the present invention and in  
5 construction of this apparatus without departing from the scope or spirit of this invention.



## CLAIMS

1. In a wireless communication device having a body and a cover, the body having a recess bordered by a left shoulder and a right shoulder for attaching the cover thereto, the device comprising:

5 a barrel integrally formed on the cover, the barrel having a closed end and an open end;

a pin molded to an exterior surface of the closed end of the barrel;

a spring disposed in the barrel;

10 a cam disposed in the barrel having a body with a front surface in contact with the spring and a rear surface with a curved profile, the cam body having a key formed thereon;

15 a follower partially disposed in the barrel having a head on one end in contact with the profile of the cam and a connector on an opposite end that extends through the open end of the barrel, wherein the connector comprises a first portion and a second portion formed on an exterior surface of the first portion;

20 wherein the pin is rotatably disposed in a cavity in the left shoulder and the connector is disposed in a cavity in the right shoulder in a manner that restricts movement of the follower when the cover is moved between an open position and a closed position.

2. The device of claim 1 wherein the curved profile of the cam forms a valley.

3. The device of claim 1 wherein the curved profile of the cam forms a plurality of peaks.

25 4. The device of claim 2 wherein the head of the follower is disposed in the valley of the curved profile when the cover is in the open position.

5. The device of claim 3 wherein the head of the follower is in contact with the plurality of peaks of the curved profile when the cover is in the closed position.

30 6. The device of claim 1 wherein the open end of the barrel forms a key slot that extends into the barrel.

7. The device of claim 6 wherein the key formed on the body of the cam fits into the key slot of the barrel thereby enabling the cam to rotate with the cover as it moves between the open and closed position.

8. A radiotelephone comprising:

a body;

a cover; and

a hinge having a recess bordered by a left shoulder and a right

5 shoulder, the hinge rotatably coupling the cover to the body and having,

a barrel integrally formed on the cover, the barrel having a closed  
end and an open end;

a pin molded to an exterior surface of the closed end of the barrel;

a spring disposed in the barrel;

10 a cam disposed in the barrel having a body with a front surface in  
contact with the spring and a rear surface with a curved profile, the  
cam body having a key formed thereon;

a follower partially disposed in the barrel having a head on one end  
in contact with the profile of the cam and a connector on an  
15 opposite end that extends through the open end of the barrel,  
wherein the connector comprises a first portion and a second  
portion formed on an exterior surface of the first portion;

wherein the pin is rotatably disposed in a cavity in the left shoulder  
and the connector is disposed in a cavity in the right shoulder in a  
20 manner that restricts movement of the follower when the cover is  
moved between an open position and a closed position.

25



Application No: GB 9900678.5  
Claims searched: 1-8

Examiner: Ben Micklewright  
Date of search: 9 February 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): E2F (FAA FAE)

Int Cl (Ed.6): E05D (11/10) E05F (1/12) H04M (1/02)

Other: Online: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2 300 881 A (MOTOROLA) See e.g. page 4 line 4 to page 5 line 34 and the figures	1-8
X	EP 0 765 063 A2 (SAMSUNG) See e.g. column 5 lines 26-36 and figures 5-9B	1-8
X	WO 93/18592 A1 (MOTOROLA) See e.g. page 6 line 7 to page 7 line 3 and the figures	1-8
X.P	US 5 764 760 (PHILIPS) See e.g. column 2 line 40 to column 3 line 4 and figures 4-6	1-8

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**